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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/777,672	02/11/2004	Valery Ray	F138	5999
25784	7590	10/19/2004	EXAMINER	
MICHAEL O. SCHEINBERG P.O. BOX 164140 AUSTIN, TX 78716-4140			SOUW, BERNARD E	
			ART UNIT	PAPER NUMBER
			2881	

DATE MAILED: 10/19/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/777,672

Applicant(s)

RAY ET AL.

Examiner

Bernard E Souw

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-29 is/are rejected.
- 7) ☒ Claim(s) 14 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. Claim 14 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 14 recites the limitation "the blanking frequency" in lines 8 and 10. There is insufficient antecedent basis for this limitation in the claim.

To proceed with this office action the wording "the blanking frequency" is ~~changed to~~ ^{interpreted as} "a blanking frequency" by the examiner.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 14-29 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Lundquist et al. (USPAT 6,576,908).

Regarding claims 14 and 20, Lundquist et al. disclose a method of using a charged particle beam (CPB), comprising a charged particle beam 520 shown in Fig.5 milling through one or more layers of material 300, as recited in sect.[0053]/lines 3-6, to expose a circuit element 310, 330, or 340 shown in Fig.3A,B,C,D, as recited in the Title and in the Abstract lines 1-14; detecting an output signal caused by the impact of the

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focused ion beam, the output signal including [*a secondary charged particle signal or*] a stage current generated by the electron-hole pairs 730 entering the depleted region 740 in Fig.7, as recited in sect.[0057]; providing the output signal to a circuit 550 adjusted to improve the signal-to-noise ratio of a signal at a blanking frequency, as recited in sect.[0053]/lines 8-12, sect.[0054]/lines 1-12 and sect.[0055]; ceasing to mill when the output of the circuit 550 adjusted to improve the signal-to-noise ratio of a signal at the blanking frequency changes more than a predetermined amount, the change indicating a change of material impacted by the charged particle beam, as recited in sect.[0058]/lines 1-7 and sect.[0060]/lines 1-6.

► Specifically regarding claim 20, the limitation of modulating signal is the same as periodically pulsing or blanking the beam 520, as recited in sect.[0058]/lines 1-3.

► Regarding claims 15 and 16, the limitation(s) of ceasing to mill when the element is uncovered before it is severed (claim 15) and/or it is severed, is an unambiguous proof of the mutually contradictory limitations of claims 15 and 16 are a mere matter of process choice, both of which are inherently recited in sect.[0058]/lines 4-13.

► Regarding claims 17, 21, 22 and 23, the use of a lock-in amplifier, a band-pass filter, or --in general-- a circuit sensitive to the frequency component of the detected signal, is recited in sect.[0053]/lines 10-12 and sect.[0054]/lines 5-12.

► Regarding claims 18 and 27, the limitation of signal from a current of secondary electrons ejected from the work piece is recited in sect.[0015]/lines 1-7, sect.[0027]/lines 1-4, sect.[0062]/lines 13-19, sect.[0069]/lines 1-5, and in claim 14, lines 4-5.

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► The frequency range limitations of claims 19, 25 and 26 are recited in sect.[0054]/lines 1-5.

► Regarding claim 28, the limitation of a focused ion or electron beam is inherent in the FIB (focused ion beam) technique used by Lundquist et al., as recited in sect.[0006]/lines 8-10, sect.[0008]/lines 1-3, sect.[0015]/lines 1-7, while specifically implicated in sect.[0051]/lines 14-16.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lundquist et al. in view of general knowledge in the art.

Lundquist et al. show all the limitations of claim 24, as previously applied to the parent claim 20, except the recitation of applying a modulating signal having a frequency greater the inverse of the breakthrough period and less than one half of the ion frequency.

It is generally known in the art, in order to process and manipulate a work piece that involves a breakthrough, the breakthrough process has to be monitored under a time resolution better (i.e., smaller) than the breakthrough process itself, i.e., a time resolution less than the breakthrough period. Therefore the modulating signal used for

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monitoring the process must be faster than the breakthrough process, or, in other words, its frequency must be greater than the inverse of the breakthrough period, as recited in the claim. The second part of the claim limitation applies especially if the ion beam itself has a repetitive frequency different than the modulation frequency, since it is also generally known in the art that a modulation frequency should not exceed the ion beam repetition frequency, whereby the number one-half is not critical.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a modulating signal frequency that is greater than the inverse of the breakthrough period, in order to process and manipulate a work piece that involves a breakthrough, since this is a general knowledge in the art that does not need any auxiliary teaching.

4. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lundquist et al. in view of general knowledge in the art.

Lundquist et al. show all the limitations of claim 29, as previously applied to the parent claim 20, except the recitation of periodically sampling the secondary charged particle beam current.

Lundquist et al. recite in sect.[0015]/lines 2-3 the limitations of (a) sampling the stage current generated by the CPB and (b) monitoring the secondary electron signal, as two viable techniques for FIB endpoint detection. It would have been obvious to one of ordinary skill in the art at the time the invention was made to mix the two techniques into "sampling the secondary electron signal", as recited in applicant's claim 29, since

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mixing two known techniques is another alternative which is already inherent in Lundquist's teaching and is generally available to one of ordinary skill in the art without a need of any auxiliary teaching.

5. Claims 1-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lundquist et al. in view of Talbot et al. (USPAT 5,140,164) or Rasmussen (USPAT 5,435,850).

Lundquist et al., either alone or in view of general knowledge in the art, show all the limitations of claims 1-13 as previously applied to claims 14-29, except the recitation that the CPB is patterned, as recited in the independent claim 1.

Talbot et al. disclose a modification of integrated circuit using a focused ion beam (FIB) system, as recited in the Title and the Abstract, for determining milling end-point, as recited in the Abstract/lines 6-10. Talbot's FIB is applied in a pattern, as recited in Col.5/ll.7-24.

Rasmussen also discloses a FIB for removing circuit structures in semiconductor devices, as recited in Col.1/ll.8-18. Rasmussen's FIB is applied in a definite raster pattern, as recited in Col.1/ll.19-21.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a modulating pattern to the milling ion beam of Lundquist's as taught by Talbot et al. and/or Rasmussen, in order to process a large area of a semiconductor circuit in one step, instead of only processing a small area of the size of the ion beam focus, as in case of Lundquist's.

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► Claim 2 recites the same limitation as claim 17 or claim 22, except for its dependence on claim 1. Claim 2 is therefore rendered obvious by the same token as previously applied to claims 17 or 22, however, with an additional prior art (Talbot et al. or Rasmussen) under U.S.C. 103 to take account for the dependency on claim 1.

► The limitations of claims 3 and 4 are inherent to the use of lock-in amplifier, as generally known in the art. Claims 3 and 4 are therefore rendered obvious by the same token over the same prior art references as previously applied to claim 2.

► The limitations of claims 5 and 6 are rendered obvious by Lundquist et al. in sect.[0056]/lines 1-11, whereby lines 7-11 specifically indicate that insulating material has not been substantially removed.

► Claim 7 recites the same limitation as claim 19. Claim 7 is therefore rendered obvious by the same token as previously applied to claim 19, however, with an additional prior art (Talbot et al. or Rasmussen) under U.S.C. 103 to take account for the dependency on claim 1.

► Claim 8 recites the same limitation as part of claim 14. Claim 8 is therefore rendered obvious by the same token as previously applied to claim 14, however, with an additional prior art (Talbot et al. or Rasmussen) under U.S.C. 103 to take account for the dependency on claim 1.

► Claims 9, 10, 12 and 13 recite the same limitation as that of claims 18, 27 and 29. Claims 9, 10, 12 and 13 are therefore rendered obvious by the same token as previously applied to claims 18, 27 and 29, however, with an additional prior art (Talbot et al. or Rasmussen) under U.S.C. 103 to take account for the dependency on claim 1.

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Specifically regarding claim 13, the limitation of an output signal not provided by way of an electrical conductor attached to the work piece is here represented by the signal of secondary electrons released by the ion beam out of the work piece.

► Claim 11 recites the same limitation as claim 28. Claim 11 is therefore rendered obvious by the same token as previously applied to claim 28, however, with an additional prior art (Talbot et al. or Rasmussen) under U.S.C. 103 to take account for the dependency on claim 1.

Communications

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bernard E Souw whose telephone number is 571 272 2482. The examiner can normally be reached on Monday thru Friday, 9:00 am to 5:00 pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R Lee can be reached on 571 272 2477. The central fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306 for regular communications as well as for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.


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October 5, 2004


JOHN R. LEE
SUPERVISORY PATENT EXAMINER
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